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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:
Fernando C. Vidaurri, et al.

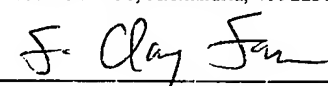
Serial No.: 10/609,087

Filed: June 27, 2005

For: METHOD TO DECREASE
CORROSIVENESS OF
REACTANTS IN POLY
(ARYLENE SULFIDE) POLYMER
PRODUCTION

§
§ Group Art Unit: 1712
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§ Examiner: Buttner, David J.
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§ Atty. Docket: CPCM:0002-1/FLE/RAR
§ 33776US01
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November 29, 2005 Date	 F. Clay Faries

Sir:

APPEAL BRIEF PURSUANT TO 37 C.F.R. §§ 41.31 AND 41.37

This Appeal Brief is being filed in furtherance to the Notice of Appeal mailed on September 20, 2005, and received by the Patent Office on September 29, 2005.

Appellants respectfully request that the Commissioner charge the requisite fee of \$500.00 for the Appeal Brief, plus any additional fees which may be required, to the credit card listed on the attached PTO-2038. However, if the PTO-2038 is missing, if the amount listed thereon is insufficient, or if the amount is unable to be charged to the credit card for any other reason, the Commissioner is authorized to charge Deposit Account No. 06-1315; Order No. CPCM:0002-1/FLE (33776US01).

1. **REAL PARTY IN INTEREST**

The real party in interest is Chevron Phillips Chemical Company LP, the Assignee of the above-referenced application by virtue of the executed Assignment, which will be directly affected by the Board's decision in the pending appeal.

2. **RELATED APPEALS AND INTERFERENCES**

Appellants are unaware of any other appeals or interferences related to this Appeal. The undersigned is Appellants' legal representative in this Appeal.

3. **STATUS OF CLAIMS**

Claims 1, 35-50, and 60-72 are currently pending, and claims 1, 35-50, and 60-72 are currently under final rejection and, thus, are the subject of this appeal.

4. **STATUS OF AMENDMENTS**

All amendments in relation to the claims of the present patent application have been entered, and no amendments have been submitted or entered subsequent to the Final Office Action mailed on June 20, 2005.

5. **SUMMARY OF CLAIMED SUBJECT MATTER**

The present application contains five independent claims, namely, claims 1, 42, 60, 61, and 70, all of which have been improperly rejected and, thus, are subject to this Appeal. The subject matter of these five independent claims, as well as dependent claims 49, 50, 68, 71, and 72, is summarized below.

An embodiment of claim 1 relates to a method for preparing polyphenylene sulfide polymer (PPS), including reacting an aqueous metal hydroxide (e.g., sodium hydroxide or NaOH) with a polar organic compound (e.g., N-methylene pyrrolidone or NMP) within a metal vessel (e.g., stainless-steel vessel) comprising iron, chromium and nickel and within a temperature range (e.g., 75° to 125° C) to form a solution having a reaction product of the metal hydroxide and the polar organic compound. The method further includes: dehydrating the solution such that at least a portion of the water is removed from the solution without isolating a solid from the solution; and contacting a sulfur source (e.g., alkali metal bisulfide, sodium bisulfide, aqueous sodium bisulfide) with the solution to form a mixture. The mixture is dehydrated at a temperature greater than 100° C such that at least a portion of the water is removed from the mixture.

In an embodiment of claim 1, the dehydrated mixture is contacted with a dihaloaromatic compound (e.g., p-dichlorobenzene or DCB) under polymerization conditions to form polyphenylene sulfide (PPS) polymers. Advantageously, the corrosiveness of the solution or the mixture with respect to the metal vessel is such that the polyphenylene sulfide polymers (PPS) produced has less than 55 ppm iron, less than 15 ppm chromium, and less than 15 ppm nickel.

An embodiment of claim 42 relates to a method for preparing polyphenylene sulfide polymer, including reacting an aqueous metal hydroxide (e.g., NaOH) with a polar organic compound (e.g., NMP) within a temperature range of 50° to 200° C to form a

solution comprising an alkali metal aminoalkanoate (e.g., sodium N-methyl-4-aminobutanoate or SMAB) without isolating a solid from the solution. The solution is dehydrated to remove water from the solution. Further, the solution is contacted with a sulfur source (e.g., alkali metal bisulfide, sodium bisulfide) to form a mixture. The mixture is maintained at a temperature greater than 100° C to remove water from the mixture. The mixture is contacted with a dihaloaromatic compound (e.g., DCB) under polymerization conditions to form polyphenylene sulfide.

An embodiment of claim 60 relates to a method for preparing polyphenylene sulfide polymer, including providing a reactor vessel comprising a metal surface (e.g., a stainless steel surface) having one or more of iron, chromium and nickel suitable for contacting: a dehydrated solution of an aqueous metal hydroxide (e.g., NaOH) and a polar organic compound (e.g., NMP); a dehydrated mixture of the dehydrated solution and a sulfur source (e.g., NaSH); and polymerization reactants comprising a dihaloaromatic compound (e.g., DCB). Polyphenylene sulfide polymers are formed in the reactor vessel, wherein polyphenylene sulfide (PPS) polymers prepared in the metal reactor vessel contain less than 55 ppm iron, less than 15 ppm chromium, or less than 15 ppm nickel.

An embodiment of claim 61 relates to a method for preparing polyphenylene sulfide polymer, including placing an aqueous metal hydroxide (e.g., aqueous NaOH) and a polar organic compound (e.g., NMP) in a metal vessel constructed of iron, chromium, and nickel; and heating the aqueous metal hydroxide and the polar organic compound in

the vessel to a reaction temperature of less than 200° C for a time interval sufficient to substantially react the metal hydroxide with the polar organic compound to form a solution comprising the polar organic compound, water, and an alkali metal aminoalkanoate (e.g., SMAB).

Further, in the method of claim 61, a sulfur source (e.g., sodium bisulfide) is added to the vessel to form a mixture of the sulfur source and the solution in the vessel. The mixture is dehydrated within the vessel at a temperature of less than 240° C such that a portion of water is removed from the vessel. The mixture is contacted with a dihaloaromatic compound (e.g., DCB) in the vessel under polymerization conditions to form polyphenylene sulfide (PPS) polymers having less than 40 ppm iron, less than 7 ppm chromium, or less than 9 ppm nickel, or any combination thereof.

An embodiment of claim 70 relates to a method for preparing polyphenylene sulfide polymer, including: reacting an aqueous metal hydroxide (e.g., NaOH) with a polar organic compound (e.g., NMP) outside of the presence of a sulfur source within a first temperature range of about 50° to about 200° C to form a solution comprising an alkali metal aminoalkanoate (e.g., sodium N-methyl-4-aminobutanoate) and the polar organic compound; contacting a sulfur source (e.g., NaSH) with the solution to form a mixture; dehydrating the mixture within a second temperature range of about 100° to about 240° C such that at least a portion of the water is removed from the mixture; and

contacting at least a dihaloaromatic compound (e.g., DCB) with the mixture under polymerization conditions to form polyphenylene sulfide.

Dependent Claims

Claims 49 and 50 depend from the method of claim 42. Claim 49 states that the mixture is maintained in the vessel in a pressure range from about atmospheric pressure to about 30 pounds per square inch (psig). Claim 50 recites that the polyphenylene sulfide comprises less than 55 ppm iron, less than 15 ppm chromium, or less than 15 ppm nickel, or any combination thereof.

Claim 68, which depends from the method of claim 61, recites that lithium halide is *not* added to the vessel.

Claims 71 and 72 depend from the method of claim 70. Claim 71 requires that lithium halide is *not* added to the sulfur source, to the solution, or to the mixture. Claim 72 recites that the polyphenylene sulfide comprises less than 40 ppm iron, less than 7 ppm chromium, or less than 9 ppm nickel.

6. GROUND OF REJECTIONS TO BE REVIEWED ON APPEAL

First Ground of Rejection:

Appellants respectfully request that the Board review and reverse the Examiner's first ground of rejection, in which dependent claims 68 and 71 were rejected under 35

U.S.C. §112, first paragraph, as failing to comply with the written description requirement.

Second Ground of Rejection:

Appellants respectfully request that the Board review and reverse the Examiner's second ground of rejection, in which claims 42-50, 70, and 72 were rejected under 35 U.S.C. §102(b) as anticipated by Senga (U.S. Patent No. 5,093,469).

Third Ground of Rejection:

Appellants respectfully request that the Board review and reverse the Examiner's third ground of rejection, in which claims 42-50, 70, and 72 were rejected under 35 U.S.C. §102(b) as being anticipated by Campbell (U.S. Patent No. 3,867,356).

Fourth Ground of Rejection:

Appellants respectfully request that the Board review and reverse the Examiner's fourth ground of rejection, in which claims 42-50, 70, and 72 were alternately rejected under 35 U.S.C. §103 as unpatentable over Senga.

Fifth Ground of Rejection:

Appellants respectfully request that the Board review and reverse the Examiner's fifth ground of rejection, in which claims 42-50, 70, and 72 were alternatively rejected under 35 U.S.C. §103 as being unpatentable over Campbell.

Sixth Ground of Rejection

Appellants respectfully request that the Board review and reverse the Examiner's sixth ground of rejection, in which claims 1, 35-50, and 60-67, 69, 70, and 72 were rejected under 35 U.S.C. § 103 over Senga in view of Koyama ('433).

Seventh Ground of Rejection

Appellants respectfully request that the Board review and reverse the Examiner's sixth ground of rejection, in which claims 1, 35-50, and 60-67, 69, 70, and 72 were rejected under 35 U.S.C. § 103 over Campbell in view of Koyama.

7. **ARGUMENT**

As discussed in detail below, the Examiner has improperly rejected the pending claims. Further, the Examiner has misapplied long-standing and binding legal precedents and principles in rejecting the claims under 35 U.S.C. §§ 102(a), 103(a), and 112. Accordingly, Appellants respectfully request full and favorable consideration by the Board, as Appellants strongly believe that claims 1, 35-50, and 60-72 are currently in condition for allowance.

First Ground of Rejection

The Examiner rejected claims 68 and 71 under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. Final Office Action, page 2. The Examiner stated that he was "unable to locate [the] basis for exclusion of lithium halide." *Id.* The Examiner asserted, incorrectly, that the present specification specifically

calls for inclusion of lithium halide. *See id.* (citing Application, page 8, line 20).

Appellants respectfully traverse this rejection.

The present specification states that the lithium halide or other molecular weight agents can be added to the reaction mixture before or during polymerization. *See* Application, page 8, line 17 – page 9, line 7. However, the specification does not necessitate the addition of lithium halide. *See id.* First, the specification provides for the addition of agents to control molecular weight but does not require the addition of such agents. *See id.* Second, if such agents are employed, compounds other than lithium halide can be utilized. *See, e.g.,* Application, page 10, lines 17-20 (discussing alkali metal carboxylate as the molecular weight modifying agent). Third, the disclosed examples do not incorporate lithium halide. *See* Application, page 12, line 15 – page 18, line 17. In sum, the exclusion of lithium halide, as claimed, is clearly supported by the discussion and examples disclosed in the present specification. *See* Application, page 8, line 17 – page 9, line 7; page 10, lines 17-20; page 12, line 15 – page 18, line 17. Accordingly, Appellants respectfully request that the Board direct the Examiner to withdraw the rejection under 35 U.S.C. § 112, first paragraph, and allow claims 68 and 71.

Lastly, Appellants note that the Senga, Campbell, and Koyoma references cited by the Examiner in the Final Office Action, whether taken alone or in combination, do not teach or suggest the features recited in claims 68 and 71. Therefore, while the Examiner

did not formulate a rejection of these claims under 35 U.S.C. §§ 102 or 103, Appellants strongly believe these claims to be patentable over the cited references.

Second Ground of Rejection

The Examiner rejected claims 42-50, 70, and 72 under 35 U.S.C. § 102 as being anticipated by Senga (5,093,469). Of these rejected claims, claims 42 and 70 are independent. Appellants respectfully traverse this rejection.

Legal Precedent

Anticipation under Section 102 can be found only if a single reference shows exactly what is claimed. *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 227 U.S.P.Q. 773 (Fed. Cir. 1985); *In re Bond*, 910 F.2d 831, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990). To maintain a proper rejection under Section 102, a single reference must teach each and every element or step of the rejected claim. *Atlas Powder v. E.I. du Pont*, 750 F.2d 1569 (Fed. Cir. 1984). Moreover, the prior art reference must show the *identical* invention “*in as complete detail as contained in the ... claim*” to support a *prima facie* case of anticipation. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 U.S.P.Q. 2d 1913, 1920 (Fed. Cir. 1989) (emphasis added).

If an Examiner is to rely on a theory of inherency, the extrinsic evidence must make clear that the missing descriptive matter is *necessarily* present in the thing described in the reference and so recognized by persons of ordinary skill. *In re*

Robertson, 169 F.3d 743, 49 U.S.P.Q.2d 1949 (Fed. Cir. 1999). In relying upon the theory of inherency, the Examiner bears the evidentiary burden in providing a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic *necessarily* flows from the teachings of the applied prior art. *Ex parte Levy*, 17 U.S.P.Q.2d 1461, 1464 (Bd. Pat. App. & Inter. 1990).

Features of Independent Claims 42 and 70 Missing from Senga

Independent claims 42 and 70 recite “reacting an aqueous metal hydroxide with a polar organic compound . . . to form a solution . . . [and] contacting a sulfur source with the solution to form a mixture.” (Emphasis added). In contrast, while Senga discloses that sodium hydroxide, NMP, and water are added to a one-liter reactor to form a solution, the solution is not contacted with a sulfur source. Instead, *benzene* is added to the Senga solution and a solid is precipitated from the solution. *See, e.g.*, col. 7, lines 45-62. Therefore, the Senga reference cannot anticipate claims 42 and 70, or the claims dependent thereon.

Further, claim 42 recites that the formed solution is contacted with the sulfur source “without isolating a solid from the solution.” (Emphasis added). Quite the opposite, as indicated, Senga discloses that a solid is isolated from the solution. *See, e.g.*, col. 7, lines 45-62. Accordingly, Senga cannot anticipate claim 42 or its dependent claims for this additional reason.

The Examiner Has Failed to Establish Inherency

In an effort to cure these deficiencies of Senga, the Examiner stated, incorrectly, that it “is apparent that isolating the dry metal aminoalkanoate [in Senga] was carried out merely to perform tests to confirm the identity of the compound” and that such isolation would not be performed commercially, “except for random quality checks.” *See* Final Office Action, page 3. The Examiner reasoned “[t]his is especially true in view of the fact that fresh N-methylene pyrrolidone is added along with the sodium hydrosulfide (col. 8, line 13) during preparation of the polyphenylenesulfide.” *See id.* The Examiner asked “[w]hy would one of ordinary skill bother to isolate the sodium methylaminobutyrate from N-methylpyrrolidone if additional N-methylpyrrolidone is to be later added along with the sulfur source?” *See id.*, at 6. However, this is exactly what is done in Senga.

Indeed, Senga teaches that the solid product (alkali metal aminoalkanoate) is removed from the solution and subsequently “used in the form of an anhydride, a hydrate or an aqueous solution, like the sodium sulfide” in the preparation of polyarylene sulfide polymer, either in the laboratory or on a commercial scale. *See* col. 2, line 34 – col. 3, line 12. Senga treats the alkali metal aminoalkanoate, sodium sulfide, and lithium halide equally as feedstocks that are added in any order to a commercial polymerization process. *See* col. 2, line 34 – col. 3, line 12; col. 6, lines 18-24. Moreover, Appellants stress that employment of the solvent N-methyl-2-pyrrolidone (NMP) in *both* the process of producing alkali metal aminoalkanoate and in the subsequent polymerization process does not indicate that the alkali metal aminoalkanoate would remain in solution as a

feedstock of the polymerization process. *See* Final Office Action, page 3; Senga, col. 6, lines 7-18. The fact that a supplier and a customer utilize the same solvent in their respective processes does not mean that the supplier will provide the product to the customer in solution in that solvent.

Again, Senga discloses that the solution is contacted with benzene (not a sulfur source) and that a solid (alkali metal aminoalkanoate) is isolated from the solution, contrary to the claims. Senga reinforces this disclosure which conflicts with the claims in stating that the alkali metal aminoalkanoate may be added to the PPS polymerization in the form of a *hydrate* (a solid) or an aqueous solution (a solid dissolved in water – not NMP). *See* Senga, col. 2, line 34 – col. 3, line 12. In sum, the Examiner has not shown that the presently-claimed feature of “contacting a sulfur source with the solution,” as recited in claims 42 and 70, and the associated feature “without isolating a solid from the solution,” as recited in claim 42, are necessarily present or necessarily flow from the teachings of the Senga reference. *See In re Robertson*, 169 F.3d, at 743; *Ex parte Levy*, 17 U.S.P.Q.2d, at 1464; Final Office Action, pages 3-6. Therefore, the Examiner has not satisfied his evidentiary burden with regard to establishing inherency. *See Ex parte Levy*, 17 U.S.P.Q.2d, at 1464.

Request Withdrawal of Rejection

For these reasons, Appellants respectfully request that the Board direct the Examiner to withdraw the rejection of claims 42-50, 70, and 72 under 35 U.S.C. § 102 based on the Senga reference and to allow the claims.

Features of Dependent Claims 50 and 72 Missing From Senga

While Appellants believe the dependent claims to be patentable over Senga by virtue of their dependency on an allowable base claim, Appellants respectfully assert that dependent claims 50 and 72 are also patentable over Senga because of the subject matter they separately recite. Dependent claim 50 recites that the polyphenylene sulfide comprises less than 55 ppm iron, less than 15 ppm chromium, or less than 15 ppm nickel, or any combination thereof. Similarly, dependent claim 72 recites that the polyphenylene sulfide comprises less than 40 ppm iron, less than 7 ppm chromium, or less than 9 ppm nickel.

In contrast, the Senga reference does not disclose the metal contamination of the PPS polymer. Indeed, Senga does not incorporate sodium hydroxide into its PPS polymerization process, as presently-claimed, and therefore, does not contemplate the corrosive effects of sodium hydroxide on equipment in the PPS process and the associated metal contamination of the PPS. See, e.g., Senga, col. 2, line 34 – col. 3, line 12; col. 6, lines 7-24. Thus, the Senga reference cannot anticipate dependent claims 50 and 72 for these reasons as well. Accordingly, Appellants respectfully request that the

Board direct the Examiner to withdraw the rejection of claims 50 and 72 under 35 U.S.C. § 102 based on the Senga reference for these additional reasons.

Third Ground of Rejection:

The Examiner rejected claims 42-50, 70, and 72 under 35 U.S.C. §102(b) as being anticipated by Campbell (U.S. Patent No. 3,867,356). Appellants respectfully traverse this rejection.

As discussed, claims 42 and 70 recite a PPS polymerization process comprising “reacting an aqueous metal hydroxide with a polar organic compound . . . to form a *solution* . . . [and] contacting a sulfur source with the *solution* to form a mixture; . . . and contacting the mixture with at least a dihaloaromatic compound . . . to form polyphenylene sulfide.” (Emphasis added). Claim 42 recites that the solution is formed and contacted with the sulfur source “without isolating a solid from the *solution*.” (Emphasis added). Conversely, the Campbell reference, like Senga, teaches the separate production of a solid alkali metal aminoalkanoate. *See* Campbell, col. 1, lines 39-55; col. 2, lines 21-40 and 45-49; col. 5, lines 53-59; col. 6, lines 14-20. This solid aminoalkanoate is added with the other feedstocks *in any order* to a subsequent PPS polymerization. *See id.*

The Examiner relied on the Examples in Campbell in formulating the instant rejection. *See* Final Office Action, pages 4-5. However, these Examples in Campbell

clearly call for the alkali metal aminoalkanoate to be isolated as a solid when produced and then subsequently added as a solid to a downstream PPS polymerization, in direct conflict with claim 42. *See* Campbell, col. 1, lines 39-55; col. 2, lines 21-40 and 45-49; col. 5, lines 53-59; col. 6, lines 14-20. Similarly, the Campbell solution of the reacted sodium hydroxide (NaOH) and NMP is not contacted with a sulfur source, contrary to both claims 42 and 70. *See id.*

Even if the alkali metal aminoalkanoate in Campbell remained in *solution* in the NMP for addition to a subsequent polymerization, Campbell, does not teach that this *solution* would be contacted with the sulfur source, as claimed. *See id.* Instead, again, the solution would be added in any order to the polymerization with respect to the other feedstocks. *See id.* Appellants note that an unwitting disclosure which is accidental, unintentional, and unappreciated does not anticipate the claims. *See Schering Corp. v. Geneva Pharm., Inc.*, 339 F.3d 1373 (Fed. Cir. 2003); *Eibel Process Co. v. Minnesota & Ont. Paper Co.*, 261 U.S. 45 (1923); *Tilghman v. Proctor*, 102 U.S. 707, 26 L.Ed. 279 (1880).

In sum, Campbell does not generate the alkali metal aminoalkanoate in *solution* in a polymerization process, and does not *contact* the recited solution *with a sulfur source*, as claimed. *See* Campbell, col. 1, lines 39-55; col. 2, lines 21-40 and 45-49; col. 5, lines 53-59; col. 6, lines 14-20. Therefore, the Campbell reference cannot anticipate claims 42 and 70, or the claims dependent thereon. Accordingly, Appellants respectfully request

that the Board direct the Examiner to withdraw the rejection of claims 42-50, 70, and 72 under 35 U.S.C. § 102 based on the Campbell reference and allow the claims.

Features of Dependent Claims 49, 50, and 72 Missing from Campbell

While Appellants believe the dependent claims to be patentable over Campbell by virtue of their dependency on an allowable base claim, Appellants respectfully assert that dependent claims 49, 50, and 72 are also patentable over Campbell because of the subject matter they separately recite. Dependent claim 49 recites that the mixture (with the addition of the sulfur source) is maintained at 100° C in the vessel in a pressure range from atmospheric pressure to 30 psig, such that at least a portion of the water is removed from the mixture.

The Examiner relied on the Campbell Example I to teach this dehydration (after addition of the sulfur source), as claimed. *See* Final Office Action, page 4, lines 19-21 (citing Campbell, col. 3, lines 36-42). However, while Applicants traverse the Examiner's equating of the Senga mixture in Example I with the claimed mixture, Campbell does not disclose the pressure of this *mixture*, either in Example I or in the entire reference. *See* Campbell, col. 3, lines 36-42. In addition, while Campbell performs an atmospheric dehydration of the solution of sodium hydroxide and NMP in the upstream production of the alkali metal aminoalkanoate, the Campbell reference, unlike claim 49, does not disclose a pressure of the *mixture* (having the sulfur source) in the PPS polymerization process. *See* Campbell, col. 3, lines 36-42; col. 5, lines 15 and 23-25. As for the polymerization pressure, Campbell teaches that the pressure is

“sufficient to maintain” the reactants in the “liquid phase,” and then discloses polymerization-pressure ranges of 70-180 psig and 100-125 psig, which are much greater than the claimed pressure range of 0-30 psig of the mixture, as recited in claim 49. *See* Campbell, col. 2, lines 61-65; col. 3, line 48; col. 4, line 8. In sum, the Examiner has failed to establish a case of anticipation with regard to dependent claim 49 based on Campbell for the additional reason that Campbell does not disclose the pressure of the second dehydration, as recited in claim 49.

Further, as discussed, claim 50 recites that the polyphenylene sulfide comprises less than 55 ppm iron, less than 15 ppm chromium, or less than 15 ppm nickel, or any combination thereof. Claim 72 recites that the polyphenylene sulfide comprises less than 40 ppm iron, less than 7 ppm chromium, or less than 9 ppm nickel. In contrast, as with Senga, Campbell fails to contemplate, much less disclose the metal contamination of the PPS polymer. *See, e.g.*, Campbell, col. 3, lines 53-58; col. 4, lines 8-14. Accordingly, the Campbell reference cannot anticipate dependent claims 50 and 72 for this reason as well. Therefore, Appellants respectfully request that the Board direct the Examiner to withdraw the rejection of dependent claims 49, 50, and 72 under 35 U.S.C. § 102 based on Campbell for these additional reasons.

Fourth Ground of Rejection

In the Final Office Action, the Examiner alternatively rejected claims 42-50, 70, and 72 under 35 U.S.C. § 103 as being unpatentable over Senga. Appellants respectfully traverse this rejection.

Legal Precedent

The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (PTO Bd. App. 1979). To establish a *prima facie* case, the Examiner must show that the modified reference includes *all* of the claimed elements, and provide a convincing line of reason as to why one of ordinary skill in the art would have found the claimed invention to have been obvious in light of the teaching of the reference. *See Ex parte Clapp*, 227 U.S.P.Q. 972 (B.P.A.I. 1985). One cannot use hindsight reconstruction to deprecate the claimed invention. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596 (Fed. Cir. 1988).

Deficiencies of the Rejection

As noted above with regard to the rejection under 35 U.S.C. § 102, the Senga reference does not teach all of the elements of the independent claims 42 and 70, nor does it suggest such elements. The Senga reference does not contemplate or disclose reacting metal hydroxide (e.g., NaOH) and a polar organic compound (e.g., NMP) in a polyphenylene sulfide (PPS) polymerization process to form an intermediate solution, and adding a sulfur source to that solution. As discussed, Senga discloses a separate non-polymerization process for manufacturing a purified, solid alkali metal aminoalkanoate. *See* Senga, col. 6, lines 7-18. The alkali metal aminoalkanoate and other feedstocks may be fed to the PPS polymerization in any order. *See* Senga, col. 6, lines 18-24.

Apparently, the Examiner proposed to modify Senga to only isolate the alkali metal aminoalkanoate as a solid when desired for “random quality checks.” *See* Final Office Action, page 3, line 16. Therefore, according to the Examiner, the alkali metal aminoalkanoate may otherwise remain in solution in the NMP for addition to a PPS polymerization. *See* Final Office Action, pages 3-4. However, the Examiner misunderstands the technology in asserting that solid alkali metal aminoalkanoate would only be isolated for “random quality checks.” Analysis of the precipitated and dried alkali metal aminoalkanoate says little or nothing about the equilibrium presence of the alkali metal aminoalkanoate in the NMP solution, and the effects of that solution (which include the aminoalkanoate, NMP, equilibrium components, and trace contaminants) on the subsequent polymerization. In other words, analysis of the isolated alkali metal aminoalkanoate is of little or no value, contrary to the Examiner’s contention, unless, of course, the alkali metal aminoalkanoate is being isolated as a solid feedstock, in conflict with the instant claims.

Appellants respectfully assert that the Examiner has employed impermissible hindsight reconstruction in the apparent modification of Senga to read on the instant claims. The Federal Circuit has warned that the Examiner must not, “fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher.” *In re Dembiczak*, F.3d 994, 999, 50 U.S.P.Q.2d 52 (Fed. Cir. 1999) (quoting *W.L. Gore & Assoc., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 U.S.P.Q. 303, 313 (Fed. Cir. 1983)). Accordingly, Appellants respectfully request that

the Board direct the Examiner to withdraw the rejection under 35 U.S.C. § 103 based on Senga and to allow the claims 42-50, 70, and 72.

Appellants note that Senga does not address the corrosive effects of the reactant sodium hydroxide used to produce the alkali metal aminoalkanoate. *See* Senga, col. 6, lines 32-39. For example, Senga discloses a lower temperature in the separate production of alkali metal aminoalkanoate. However, Senga does *not* impose an intermediate ceiling temperature (e.g., 50° to 200° C recited in claims 42 and 70) as is performed in the claimed PPS polymerization process of independent claims 42 and 70 to reduce the corrosive effect of the sodium hydroxide. Instead, the cited reference discloses higher temperature limits of the polymerization directed to preventing degradation of the polymer with no mention of the corrosive effects of sodium hydroxide and the resulting metal contamination of the PPS. *See id.* Clearly, Senga does not consider issues of metallurgy, corrosion, and metal contamination (of the PPS) associated with production of alkali metal aminoalkanoate in a PPS polymerization.

Dependent Claims

Further, as discussed above, Senga fails to teach the subject matter related to the claimed metal concentrations separately recited in dependent claims 50 and 72. Therefore, Appellants respectfully assert that the dependent claims 50 and 72 are also patentable by virtue of the subject matter they separately recite. Accordingly, Appellants

respectfully request that the Board direct the Examiner to withdraw the rejection of claims 50 and 72 under U.S.C. § 103 based on Senga for this reason as well.

Fifth Ground of Rejection

The Examiner also alternatively rejected claims 42-50, 70, and 72 under 35 U.S.C. § 103 as being unpatentable over Campbell. Appellants respectfully traverse this rejection.

Deficiencies of the Rejection

As discussed above, the Campbell reference does not disclose features recited in independent claims 42 and 70, nor does it suggest such features. Instead, the Campbell reference teaches the separate production of an alkali metal aminoalkanoate, which can be added to the polymerization in any order. *See* Campbell, col. 1, lines 39-55; col. 2, lines 21-40 and 45-49; col. 5, lines 53-59 and col. 6, lines 14-20. “It is within the scope of this invention to bring the polyhalo-substituted aromatic compound, the alkali metal bisulfide, the alkali metal aminoalkanoate, and the organic amide into contact *in any order*.” Campbell, col. 3, lines 15-18 (emphasis added).

The reference fails to teach or suggest at least the specific features recited in the instant claims of “contacting a sulfur source with the solution,” as recited in claims 42 and 70, and the associated feature “without isolating a solid from the solution,” as recited in claim 42. Accordingly, Appellants respectfully request that the Board direct the

Examiner to withdraw the rejection of claims 42-50, 70, and 72 under 35 under U.S.C. § 103 based on Campbell and to allow the claims.

Dependent Claims

Further, as discussed above, Campbell fails to teach the subject matter separately recited in dependent claims 49, 50, and 72. Therefore, Appellants respectfully assert that the dependent claims 49, 50, and 72 are also patentable by virtue of the subject matter they separately recite. Accordingly, Appellants respectfully request that the Board direct the Examiner to withdraw the rejection of claims 49, 50, and 72 under U.S.C. § 103 based on Campbell for this reason as well.

Sixth Ground of Rejection

The Examiner rejected claims 1, 35-50, and 60-67, 69, 70, and 72 under 35 U.S.C. § 103 over Senga in view of Koyama ('433). Claims 1, 42, 60, 61, and 70 are independent. Appellants respectfully traverse this rejection.

Features of Independent Claims 42 and 70 Missing from the Cited Combination

With regard to independent claims 42 and 70, Koyoma does not obviate the deficiencies of the Senga reference discussed above. Accordingly, the Examiner has failed to establish a *prima facie* case of obviousness with respect to claims 42 and 70, or their dependent claims.

Features of Independent Claims 1, 60, and 61 Missing from the Cited Combination

Independent claim 1 recites (emphasis added):

reacting an aqueous *metal hydroxide* with a polar organic compound within a *metal vessel comprising iron, chromium and nickel* and . . . contacting a sulfur source with the solution to form a mixture; [and]

contacting at least a dihaloaromatic compound, with the mixture under polymerization conditions to form polyphenylene sulfide polymers, wherein the corrosiveness of at least one of the solution or the mixture to the metal vessel is such that the *polyphenylene sulfide polymers comprise less than 55 ppm iron, less than 15 ppm chromium, or less than 15 ppm nickel*, or any combination thereof.

Independent claim 60 recites (emphasis added):

providing a *reactor vessel comprising a metal surface comprising one or more of iron, chromium and nickel* suitable for contacting at least a dehydrated solution of an aqueous metal hydroxide and a polar organic compound, a dehydrated mixture of the dehydrated solution and a sulfur source, and polymerization reactants comprising at least one dihaloaromatic compound; and forming polyphenylene sulfide polymers in the reactor vessel, wherein *polyphenylene sulfide polymers prepared in the metal reactor vessel contain less than 55 ppm iron, less than 15 ppm chromium, or less than 15 ppm nickel*.

Independent claim 61 recites (emphasis added):

placing an aqueous metal hydroxide and a polar organic compound within a metal vessel comprising iron, chromium, and nickel;

heating the aqueous metal hydroxide and the polar organic compound in the vessel to a reaction temperature of less than 200° C for a time interval sufficient to substantially react the metal hydroxide with the polar organic compound to form a solution comprising the polar

organic compound, water, and an alkali metal aminoalkanoate;

adding a sulfur source to the vessel to form a mixture of the sulfur source and the solution; [and]
contacting at least a dihaloaromatic compound with the mixture in the vessel under polymerization conditions to form *polyphenylene sulfide polymers comprising less than 40 ppm iron, less than 7 ppm chromium, or less than 9 ppm nickel*, or any combination thereof.

Conversely, the Senga reference does not teach or suggest reacting a metal hydroxide and a polar organic compound in the same vessel or reactor as that of the PPS polymerization. Instead, Senga discloses that the sodium hydroxide and NMP are reacted in a 1-liter reactor, and the subsequent preparation of PPS is performed in a *different* 1-liter autoclave. *See, e.g.*, col. 7, lines 43-49; col. 8, lines 8-15. Indeed, in contrast to the recitations in independent claims 1, 60, and 61, Senga is absolutely *devoid* of conducting the PPS *polymerization* in the *same* reactor or vessel as that used to *react the metal hydroxide and the polar organic compound*. The secondary Koyoma reference does nothing to obviate this deficiency of Senga. Accordingly, claims 1, 60, and 61, and their dependent claims, are believed to be patentable over the cited combination of Senga and Koyoma.

Further, the cited references, taken alone or in combination, do not teach or suggest PPS polymers having the claimed ppm metal concentrations. Indeed, the references are absolutely *devoid* of any indication of corrosion of the process equipment and the associated metal contamination of the PPS polymer. Moreover, Appellants traverse the Examiner's assertion that the claimed metal concentrations of the PPS are

inherent in Senga. See Final Office Action, pages 4-5. First, as explained above, Appellants traverse the Examiner's assertion that Senga teaches or suggests the process features recited in the instant claims. Second, even assuming that Senga disclosed the recited process features, the Examiner has not satisfied his evidentiary burden to support the assertion that the claimed metal concentrations are *inherent* (i.e., necessarily present) in the Senga polymer. See *Ex parte Levy*, 17 U.S.P.Q.2d, at 1464. Therefore, the Examiner has failed to establish that the claimed metal contamination of the PPS is *inherent* in Senga. For these additional reasons, claims 1, 60, and 61, and their dependent claims, are believed to be patentable over the cited combination of Senga and Koyoma. In view of these deficiencies, the Examiner has failed to establish a *prima facie* case of obviousness with respect to independent claims 1, 60 and 61, and their dependent claims.

Senga Teaches Away from Reacting NaOH and NMP in the Polymerization Reactor

Further, it should be noted that Senga teaches away from incorporating the sodium hydroxide as a reactant in the same vessel as the PPS polymerization reactor, as claimed. For example, as mentioned, while Senga discloses a lower temperature in the separate production of alkali metal aminoalkanoate, Senga does not impose an intermediate ceiling temperature (e.g., less than 200° C, as recited in claim 61) within the PPS polymerization process that addresses the corrosive effects of the reactant sodium hydroxide used to produce the alkali metal aminoalkanoate. See, e.g., Senga, col. 6, lines 32-39. Therefore, if the Examiner has proposed to modify Senga to incorporate the production of alkali metal aminoalkanoate in the PPS polymerization reactor, as presently-claimed, such a

proposed modification is improper because the Senga reference teaches away from the modification by *not* providing a reasonable reaction temperature in the polymerization. *See In re Grasselli*, 713 F.2d 731, 743, 218 U.S.P.Q. 769, 779 (Fed. Cir. 1983); M.P.E.P. § 2145.

Similarly, Senga also teaches away from such a modification for the similar reason that Senga provides for a one-stage reaction at a stationary temperature in the commercial PPS polymerization. Therefore, Senga *precludes* the production of a metal aminoalkanoate at a lower temperature range (e.g., less than 200° C, as recited in claim 61) relative to the polymerization temperature, as claimed. *See* Senga, col. 6, lines 51-52. A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984). Moreover, the proposed modification of Senga to produce the aminoalkanoate in Senga polymerization at a lower temperature, as claimed, would change the principle of operation of the Senga one-stage reaction which is conducted at stationary temperature. *See In re Ratti*, 270 F.2d 810, 123 U.S.P.Q. 349 (CCPA 1959); *see* M.P.E.P. § 2143.01. Thus, there is no suggestion or motivation to make the proposed modification. M.P.E.P. § 2143.01 (citing *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)).

Request Withdrawal of Rejection

Accordingly, Appellants respectfully request that the Board direct the Examiner to withdraw the rejections of claims 1, 35-50, and 60-67, 69, 70, and 72 under 35 U.S.C. § 103 based on the combination of Senga and Koyoma, and to allow the claims.

Dependent Claims

Further, Koyoma does not obviate the deficiencies of the Senga with regard to the subject matter separately recited in dependent claims 50 and 72. Therefore, the Examiner has failed to establish a *prima facie* case of obviousness with respect to claims 50 and 72 based on the cited combination for this additional reason. Accordingly, for these additional reasons, Appellants respectfully request that the Board direct the Examiner to withdraw the rejections of claims 50 and 72 under 35 U.S.C. § 103 based on the combination of Senga and Koyoma.

Seventh Ground of Rejection

Lastly, the Examiner rejected claims 1, 35-50, and 60-67, 69, 70, and 72 under 35 U.S.C. § 103 over Campbell in view of Koyoma. Again, claims 1, 42, 60, 61, and 70 are independent. Appellants respectfully traverse this rejection.

Features of Independent Claims 42 and 70 Missing from the Cited Combination

With regard to independent claims 42 and 70, Koyoma does not obviate the deficiencies of the Campbell reference discussed above. Accordingly, the Examiner has

failed to establish a *prima facie* case of obviousness with respect to claims 42 and 70, or their dependent claims.

Features of Independent Claims 1, 60, and 61 Missing from the Cited Combinations

Again, independent claim 1 recites “reacting an aqueous *metal hydroxide* with a polar organic compound within a metal vessel . . . [and] *contacting a sulfur source* with the solution to form a mixture . . . and contacting at least a dihaloaromatic compound with the mixture under polymerization conditions to *form polyphenylene sulfide polymers.*” (Emphasis added).

Similarly, independent claim 60 recites “providing a reactor vessel . . . suitable for contacting at least a dehydrated solution of an aqueous *metal hydroxide* and a polar organic compound, a dehydrated mixture of the dehydrated solution and a *sulfur source*, and polymerization reactants comprising at least one dihaloaromatic compound; and *forming polyphenylene sulfide polymers* in the reactor vessel.” (Emphasis added).

Lastly, independent claim 61 recites “placing an aqueous *metal hydroxide* and a polar organic compound within a metal vessel . . . [and] adding a *sulfur source* to the vessel to form a mixture of the sulfur source and the solution; [and] contacting at least a dihaloaromatic compound with the mixture in the vessel under *polymerization* conditions to form *polyphenylene sulfide polymers.*”

Conversely, the Campbell reference does not teach or suggest reacting a metal hydroxide and a polar organic compound in the same vessel or reactor as that of the PPS polymerization. Instead, Campbell discloses that the sodium hydroxide and NMP are reacted in a 1-liter reactor (in Examples III ad IV), and the subsequent preparation of PPS is performed in a stirred autoclave (in Examples I and II). *See* Campbell, col. 3, line 26 – col. 4, lines 14; col. 5, line 43 – col. 6, line 20. Indeed, there is no indication in Campbell that the two different Campbell processes are carried out in the same vessel or reactor. *See, generally, id.* Moreover, the secondary Koyoma reference does nothing to obviate this deficiency of Campbell. Accordingly, claims 1, 60, and 61, and their dependent claims, are believed to be patentable over the cited combination of Campbell and Koyoma.

Further, claim 1 recites “wherein the corrosiveness of at least one of the solution or the mixture to the metal vessel is such that the *polyphenylene sulfide polymers comprise less than 55 ppm iron, less than 15 ppm chromium, or less than 15 ppm nickel, or any combination thereof.*” (Emphasis added). Similarly, independent claim 60 recites “wherein polyphenylene sulfide *polymers* prepared in the metal reactor vessel *contain less than 55 ppm iron, less than 15 ppm chromium, or less than 15 ppm nickel.*” (Emphasis added). Lastly, independent claim 61 recites contacting at least a dihaloaromatic compound with the mixture in the vessel under polymerization conditions to form polyphenylene sulfide *polymers comprising less than 40 ppm iron, less than 7 ppm chromium, or less than 9 ppm nickel, or any combination thereof.*” (Emphasis added).

In contrast, the Campbell reference does not teach or suggest the claimed metal concentrations in the PPS polymer. In addition, the Koyoma reference cited by the Examiner as the secondary reference in the combination does nothing to obviate these deficiencies of Campbell. Indeed, the references are absolutely devoid of any indication of corrosion and the associated metal contamination of PPS polymers.

Moreover, Appellants traverse the Examiner's assertion that the claimed metal concentrations of the PPS are *inherent* in Campbell. *See* Final Office Action, pages 4-5. First, Appellants traverse the Examiner's contention that the cited combination teaches process features as recited in the claims. Second, even assuming that the cited combination did teach the recited process features, the Examiner has failed to satisfy his evidentiary burden in demonstrating that the claimed metal concentrations are necessarily present in the Campbell PPS. *See Ex parte Levy*, 17 U.S.P.Q.2d, at 1464. It is clear that the Examiner has failed to put forth a reference that teaches or suggests, expressly or inherently, such metal concentrations.

In view of these deficiencies, the Examiner has failed to establish a *prima facie* case of obviousness with respect to independent claims 1, 60 and 61, and their dependent claims.

Request Withdrawal of Rejections

Accordingly, Appellants respectfully request that the Board direct the Examiner to withdraw the rejections of claims 1, 35-50, and 60-67, 69, 70, and 72 under 35 U.S.C. § 103 based on the combination of Campbell and Koyoma, and to allow the claims.

Dependent Claims


Further, Koyoma does not obviate the deficiencies of Campbell with regard to the subject matter separately recited in dependent claims 49, 50, and 72. Therefore, the Examiner has failed to establish a *prima facie* case of obviousness with respect to claims 49, 50, and 72 based on the cited combination of Campbell and Koyoma for this additional reason. Accordingly, for these additional reasons, Appellants respectfully request that the Board direct the Examiner to withdraw the rejections of claims 49, 50, and 72 under 35 U.S.C. § 103 based on the combination of Campbell and Koyoma.

CONCLUSION

If the Examiner or the Board believes that a telephonic interview would assist in the prosecution of the present application to allowance, such an interview with the undersigned is sincerely invited.

Respectfully submitted,

Date: November 29, 2005



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8. **APPENDIX OF CLAIMS ON APPEAL**

1. (previously presented) A method for preparing polyphenylene sulfide polymer, comprising:

reacting an aqueous metal hydroxide with a polar organic compound within a metal vessel comprising iron, chromium and nickel and within a temperature range to form a solution having a reaction product of the metal hydroxide and the polar organic compound;

dehydrating the solution such that at least a portion of the water is removed from the solution without isolating a solid from the solution;

contacting a sulfur source with the solution to form a mixture;

dehydrating the mixture at a temperature greater than 100° C such that at least a portion of the water is removed from the mixture; and

contacting at least a dihaloaromatic compound, with the mixture under polymerization conditions to form polyphenylene sulfide polymers, wherein the corrosiveness of at least one of the solution or the mixture to the metal vessel is such that the polyphenylene sulfide polymers comprise less than 55 ppm iron, less than 15 ppm chromium, or less than 15 ppm nickel, or any combination thereof.

2-34. (cancelled).

35. (previously presented) The method as recited in claim 1, wherein the temperature range is 50° to 200° C to form the solution.

36. (previously presented) The method as recited in claim 1, wherein the temperature range is 75° to 125° C to form the solution.

37. (previously presented) The method as recited in claim 1, wherein the aqueous metal hydroxide comprises sodium hydroxide.

38. (previously presented) The method as recited in claim 1, wherein the polar organic compound comprises N-methyl-2-pyrrolidone.

39. (previously presented) The method as recited in claim 1, wherein the reaction product comprises sodium N-methyl-4-aminobutanoate.

40. (previously presented) The method as recited in claim 1, wherein the sulfur source comprises an alkali metal bisulfide.

41. (previously presented) The method as recited in claim 1, wherein dehydrating the mixture occurs at less than 240° C.

42. (previously presented) A method for polymerizing polyphenylene sulfide, comprising:

reacting an aqueous metal hydroxide with a polar organic compound within a temperature range of 50° to 200° C to form a solution comprising an alkali metal aminoalkanoate without isolating a solid from the solution;

dehydrating the solution to remove at least a portion of the water from the solution;

contacting a sulfur source with the solution to form a mixture;

maintaining the mixture at greater than 100° C, such that at least a portion of the water is removed from the mixture; and

contacting the mixture with at least a dihaloaromatic compound, under polymerization conditions to form polyphenylene sulfide.

43. (previously presented) The method as recited in claim 42, wherein the temperature range is 75° - 125° C.

44. (previously presented) The method as recited in claim 42, wherein maintaining the mixture occurs at less than 240° C.

45. (previously presented) The method as recited in claim 42, wherein the aqueous metal hydroxide comprises sodium hydroxide.

46. (previously presented) The method as recited in claim 42, wherein the polar organic compound comprises N-methyl-2-pyrrolidone.

47. (previously presented) The method as recited in claim 42, wherein the alkali metal aminoalkanoate comprises sodium N-methyl-4-aminobutanoate.

48. (previously presented) The method as recited in claim 42, wherein the sulfur source comprises an alkali metal bisulfide.

49. (previously presented) The method as recited in claim 42, maintaining the mixture occurs at a pressure range from atmospheric pressure to about 30 p.s.i.g.

50. (previously presented) The method as recited in claim 42, wherein the polyphenylene sulfide comprises less than 55 ppm iron, less than 15 ppm chromium, or less than 15 ppm nickel, or any combination thereof.

51-59. (cancelled).

60. (previously presented) A method for producing polyphenylene sulfide polymers in a metal reactor vessel, comprising:

providing a reactor vessel comprising a metal surface comprising one or more of iron, chromium and nickel suitable for contacting at least a dehydrated solution of an aqueous metal hydroxide and a polar organic compound, a dehydrated mixture of the dehydrated solution and a sulfur source, and polymerization reactants comprising at least one dihaloaromatic compound; and

forming polyphenylene sulfide polymers in the reactor vessel, wherein polyphenylene sulfide polymers prepared in the metal reactor vessel contain less than 55 ppm iron, less than 15 ppm chromium, or less than 15 ppm nickel.

61. (previously presented) A method for polymerizing polyphenylene sulfide, comprising:

placing an aqueous metal hydroxide and a polar organic compound within a metal vessel comprising iron, chromium, and nickel;

heating the aqueous metal hydroxide and the polar organic compound in the vessel to a reaction temperature of less than 200° C for a time interval sufficient to substantially react the metal hydroxide with the polar organic compound to form a

solution comprising the polar organic compound, water, and an alkali metal aminoalkanoate;

adding a sulfur source to the vessel to form a mixture of the sulfur source and the solution;

dehydrating the mixture within the vessel at a temperature of less than 240° C such that a portion of water is removed from the vessel; and

contacting at least a dihaloaromatic compound with the mixture in the vessel under polymerization conditions to form polyphenylene sulfide polymers comprising less than 40 ppm iron, less than 7 ppm chromium, or less than 9 ppm nickel, or any combination thereof.

62. (previously presented) The method as recited in claim 61, wherein the aqueous metal hydroxide comprises sodium hydroxide.

63. (previously presented) The method as recited in claim 61, wherein the polar organic compound comprises N-methyl-2-pyrrolidone.

64. (previously presented) The method as recited in claim 61, wherein the vessel containing the aqueous metal hydroxide and the polar organic compound is degassed with nitrogen.

65. (previously presented) The method as recited in claim 61, wherein the reaction temperature is approximately 100° C.

66. (previously presented) The method as recited in claim 61, wherein the time interval is approximately one hour.

67. (previously presented) The method as recited in claim 61, wherein the alkali metal aminoalkanoate comprises sodium N-methyl-4-aminobutanoate.

68. (previously presented) The method as recited in claim 61, wherein lithium halide is not added to the vessel.

69. (previously presented) The method as recited in claim 61, wherein heating comprises heating the aqueous metal hydroxide and the polar organic compound in the vessel to between 50° and 200° C.

70. (previously presented) A method for preparing polyphenylene sulfide polymer, comprising:

reacting an aqueous metal hydroxide with a polar organic compound outside of the presence of a sulfur source within a first temperature range of about 50° to about 200° C to form a solution comprising an alkali metal aminoalkanoate and the polar organic compound;

contacting a sulfur source with the solution to form a mixture;

dehydrating the mixture within a second temperature range of about 100° to about 240° C such that at least a portion of the water is removed from the mixture; and

contacting at least a dihaloaromatic compound with the mixture under polymerization conditions to form polyphenylene sulfide.

71. (previously presented) The method of claim 70, wherein a lithium halide is not added to the sulfur source, to the solution, or to the mixture.

72. (previously presented) The method of claim 70, wherein the polyphenylene sulfide comprises less than 40 ppm iron, less than 7 ppm chromium, or less than 9 ppm nickel, or any combination thereof.

9. **APPENDIX OF EVIDENCE**

None.

10. APPENDIX OF RELATED PROCEEDINGS

None.